Reissue

DILLIS V. ALLEN
ATTORNEY AT LAW
1080 Nerge Road, Suite 205
Elk Grove Village, Illinois 60007

(847) 895-9100

August 19, 1999

U.S. Commissioner of Patents
and Trademarks
Washington, D.C. 20231

RE: Continuation of Continuation of Reissue Application, U.S. Serial No. 08/880,748, Filed: 6-23-97, a Continuation of Reissue Application U.S. Serial No. 08/369,910, Filed: 1-9-95 Patent No. 5,301,941 Issued: April 12, 1994
IMPROVED GOLF CLUB HEAD WITH INCREASED RADIUS OF GYRATION AND FACE REINFORCEMENT

Dear Sir:

Enclosed please find the following:

1. Continuation of Continuation of Reissue Application, U.S. Serial No. 08/880,748, Filed: 6-23-97;
2. Four sheets of Formal Drawings
3. Continuation of Reissue Application Oath
4. Appendix to Continuation of Reissue Application Oath
5. Offer to Surrender
6. Title Report Order
7. Small Entity Declaration Independent Inventor
8. Small Entity Declaration Small Business Concern
9. Return Postcard

My check in the amount of $561 is enclosed representing $380 for the filing fee, $156 for four new independent claims, and $25 for the Title Report Order.

Please give this application the earliest possible filing date.

Very truly yours,

Dillis V. Allen

DVA/dkm
enclosures

Applicant or Patentee: Dillis V. Allen Attorney's
Serial or Patent No.: Docket No.: G-31
Files or Issued:
For: IMPROVED GOLF CLUB HEAD WITH INCREASED RADIUS OF GYRATION AND FACE REINFORCEMENT

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9 (f) and 1.27 (b)) - INDEPENDENT INVENTOR

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9 (c) for purposes of paying reduced fees under section 41 (a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled IMPROVED GOLF CLUB HEAD WITH INCREASED RADIUS OF GYRATION AND FACE REINFORCEMENT described in

- (x) the specification filed herewith
- ( ) application serial no. _____, filed _____
- ( ) patent no. _____, issued _____

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9 (c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9 (d) or a nonprofit organization under 37 CFR 1.9 (e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract of law to assign, grant, convey, or license any rights in the invention is listed below:

- ( ) no such person, concern, or organization
- (x) persons, concern or organizations listed below*

*NOTE: Separate verified statements are required from each named person, concern, or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

FULL NAME VARDON GOLF COMPANY, INC.
ADDRESS 1080 Nerge Road - Suite 205, Elk Grove Village, Illinois 60007
( ) INDIVIDUAL (x) SMALL BUSINESS CONCERN ( ) NONPROFIT ORGANIZATION

FULL NAME _____
ADDRESS _____
( ) INDIVIDUAL ( ) SMALL BUSINESS CONCERN ( ) NONPROFIT ORGANIZATION

FULL NAME _____
ADDRESS _____
( ) INDIVIDUAL ( ) SMALL BUSINESS CONCERN ( ) NONPROFIT ORGINIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28 (b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Dillis V. Allen		
NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
Signature of Inventor	Signature of Inventor	Signature of Inventor
8/19/99		
Date	Date	Date

Applicant or Patentee: Dillis V. Allen
Serial or Patent No.:
Filed or Issued:
For: IMPROVED GOLF CLUB HEAD WITH INCREASED RADIUS OF GYRATION AND FACE REINFORCEMENT

Attorney's Docket No.: G-31

VERIFIED STATEMENT (DECLARATION). CLAIMING SMALL ENTITY STATUS
(37 cfr 1.9 (f) and 1.27 (c)) - SMALL BUSINESS CONCERN

I hereby declare that I am

(X) the owner of the small business concern identified below:
( ) an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN VARDON GOLF COMPANY, INC.
ADDRESS OF CONCERN 1080 Nerge Road - Suite 205
Elk Grove Village, Illinois 60007

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9 (d), for purposes of paying reduced fees under section 41 (a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled, IMPROVED GOLF CLUB HEAD WITH INCREASED RADIUS OF GYRATION AND FACE REINFORCEMENT by inventor(s) Dillis V. Allen

described in

(x) the specification filed herewith
( ) application serial no. _____, filed _____.
( ) patent no. _____, issued _____.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9 (d) or by any concern which would not qualify as a small business concern under 37 CFR 1.9 (d) or a nonprofit organization under 37 CFR 1.9 (e).
*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

NAME VARDON GOLF COMPANY, INC.
ADDRESS 1080 Nerge Road - Suite 205, Elk Grove Village, Illinois 60007
( ) INDIVIDUAL (X) SMALL BUSINESS CONCERN ( ) NONPROFIT ORGANIZATION

NAME _____
ADDRESS _____
( ) INDIVIDUAL ( ) SMALL BUSINESS CONCERN ( ) NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28 (b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Dillis V. Allen
TITLE OF PERSON OTHER THAN OWNER President
ADDRESS OF PERSON SIGNING 1080 Nerge Road - Suite 205
Elk Grove Village, Illinois 60007
SIGNATURE _____ DATE 8/19/99

larly a redistribution of the weight of the head itself away from the hitting area to the perimeter around the hitting area, usually by providing a perimeter wall extending rearwardly from the face that results in a rear cavity behind the ball striking area. Such a clubhead configuration has been found over the last two plus decades to enable the average golfer, as well as the professional, to realize a more forgiving hitting area and by that we mean that somewhat off-center hits from the geometric face of the club results in shots substantially the same as those hits on the geometric center of the club. Today it is not uncommon to find a majority of professional golfers playing in any tournament with investment cast perimeter weighted irons confirming the validity of this perimeter weighting technology.

Metal woods by definition are perimeter weighted because in order to achieve the weight limitation of the clubhead described above with stainless steel materials, it is necessary to construct the walls of the clubhead very thin which necessarily produces a shell-type construction where the rearwardly extending wall extends from the perimeter of the forward ball striking wall, and this results in an inherently perimeter weighted club, not by design but by a logical requirement.

In the Raymont, U.S. Pat. No. 3,847,399 issued Nov. 12, 1974, assigned to the assignee of the present invention, a system is disclosed for increasing the perimeter weighting effect of a golf club by a pattern of reinforcing elements in the ball striking area that permits the ball striking area to be lighter than normal, enabling the designer to utilize that weight saved on the forward face by adding it to the perimeter wall and thereby enhancing perimeter weighting.

This technique devised by Mr. Raymont was adopted in the late 1980s by many tool designers of investment cast metal woods to increase the strength of the forward face of the metal woods to maintain the requirement for total overall head weight and to redistribute the weight to the relatively thin investment cast perimeter walls permitting these walls to not only have greater structural integrity and provide easier molding and less rejects, but also to enhance the perimeter weighting of these metal woods. Most major companies in the golf industry manufacturing metal woods in the late 1980s were licensed under the Raymont patent.

In 1991, the Allen, U.S. Pat. No. 5,060,951 issued entitled "Metal Headed Golf Club With Enlarged Face", also assigned to the assignee of the present invention, and it discloses an investment cast metal wood with an enlarged club face depth (height) on the order of at least 1.625 inches. Such a face depth was not formerly believed possible because of the requirement for face structural integrity under the high impact loads at 100 to 150 feet per second, and the weight requirements of the clubhead of 195 to 210 grams. In this Allen patent, a labyrinth of reinforcing elements similar to Mr. Raymont's was utilized not to re-distribute face weight but instead to enlarge face area while maintaining overall clubhead weight. An ancillary and important advantage of this development, utilized by many present day designers of "jumbo" metal wood heads, is the fact that an enlarged club face produces a sweet spot enlargement far greater than the enlargement of the club face itself.

There are however limitations on the effectiveness of the reinforcing elements on the face wall of investment cast clubs and particularly metal woods. Because invest-

ment cast metal woods must have hollow interiors, these interiors must be formed by removable core pieces. To the present day face wall reinforcement has been effected in accordance with the above Raymont and Allen patents by forming integral ribs and bars on the rear surface of the forward ball striking wall. In order to effect this rib pattern, the core pieces that form the rear surface of the ball striking wall, as well as the ribs themselves, must be withdrawn rearwardly in order to clear the ribs. However, the perimeter wall extending rearwardly from the forward wall inhibits the direct rearward removal of these core pieces from the forward wall during the casting operation. Therefore, it has been commonplace to either make these reinforcing elements very shallow on the order of 0.030 to 0.050 inches in rearward depth or to rearwardly taper the ribs almost to a point extending rearwardly from the forward face so that these core pieces can move laterally somewhat as they are removed from the forward wall at the completion of the casting cycle.

These limitations detract from the effectiveness of the reinforcing elements and their capability of achieving a lighter front ball striking wall. As described in the Raymont patent, the effectiveness of the reinforcement of the forward wall is determined by the "I" or "T" beam configuration of the reinforcing elements. The amount of reinforcement is determined in part by the depth and width of the reinforcing walls in a plane transverse of the ball striking wall at its point furthest from the ball striking wall. In an "I" beam configuration, the width of the cross piece away from the forward wall, can be selected as desired but is extremely difficult to mold because of the undercut on the rear web. Such increase in web width and augmentation of the depth of the reinforcement has not to this date been possible prior to the present invention, and hence the full advantages of increased perimeter weighting, superior face reinforcement, and face enlargement have not been thus far fully exploited.

Another problem addressed by the present invention is the achievement of increasing the benefits of perimeter weighting by simply adding weight to the perimeter of the clubhead itself. This technique of course has found considerable success in low inpact clubheads such as putters, where overall clubhead weight is in no way critical, and in fact in many low impact clubs that have found considerable commercial success, the clubheads weigh many times that of metal wood heads, sometimes three or four times as heavy.

To this date, however, increased perimeter weighting has not been found easy because of the weight and impact strength requirements in metal woods. An understanding of perimeter weighting must necessarily include a discussion of the parameter radius of gyration. The radius of gyration in a golf clubhead is defined as the radius from the geometric or ball striking axis of the club along the club face to points of clubhead mass under consideration. Thus in effect the radius of gyration is the moment arm or torquing arm for a given mass under consideration about the ball striking point. The total moments acting on the ball during impact is defined as the sum of the individual masses multiplied by their moment arms or radii of gyration. And this sum of the moments can be increased then by either increasing the length of the individual moment arms or by increasing the mass or force acting at that moment arm or combinations of the two.

Since it is not practical, except for the techniques discussed in the above Raymont and Allen patents, to add weight to the perimeter wall because of the weight limitations of metal woods and particularly the driving woods, one alternative is to increase the moment arm or radius of gyration. This explains the popularity of today's "jumbo" woods although many of such woods do not have enlarged faces because of the requirement for structural integrity in the front face.

Another problem arises from the aerodynamics of today's metal woods as well as those of the "wooden" type. The top wall in many metal and wooden woods has an aerodynamic shape but due to the configuration of the sole plate and the back wall, there is no possible air foil lift generated in the normal clubhead impact speed range of 100 to 150 feet per second. In fact, there can be a negative lift or downward drag on the clubhead as the head moves through the hitting area due to the fact that the length of the air stream passing under the clubhead is greater than the length of the air stream passing over the top wall because the sum of the length of the sole plate and back wall in a vertical plane passing down the target line through the clubhead is greater than the length of the top wall in the same plane. Applying the law of continuity to these parameters results in the air stream along the bottom of the clubhead having a lower pressure than the air stream passing along the top of the clubhead and hence a resulting downward force on the clubhead as it passes through the hitting area at high speed.

It is a primary object of the present invention to ameliorate the problems of interior face reinforcement, increasing the radius of gyration, and improving the aerodynamic characteristics of a high impact golf clubhead.

SUMMARY OF THE PRESENT INVENTION

In accordance with the present invention, an improved high impact metal clubhead is provided with a unique composite face wall, increased radius of gyration, and a positive lift air foil contour.

Toward these ends, the composite face wall includes an impact supporting wall that is investment cast with the remainder of the head(without the sole plate which is a separate piece as cast). This impact supporting wall is rigidified by a pattern of integrally cast reinforcing bars that extend forwardly from the forward wall rather than rearwardly as described in the above discussed Raymont and Allen patents. This reinforcing pattern has a depth of approximately 0.150 inches which is significantly greater than reinforcing patterns possible on the rear of the ball striking faces of prior constructions. This increased depth provides far greater supporting wall reinforcement. It is also easily cast because the core piece that forms these deep depth reinforcing elements are removed by a direct forward withdrawal unencumbered by the perimeter wall that inhibits rearward core withdrawal inside the clubhead. In the exemplary embodiment of this pattern of reinforcing bars, the reinforcing bars are formed into hexagonal unit cells having a major diameter of 0.500 inches, although other geometric patterns are within the scope of the present invention.

This reinforced supporting wall is covered by a very hard plastic ball striking insert that is cast in situ(in place) over the supporting wall. That is, after the head is investment cast, the forward wall is cleaned and vulcanized with a bonding agent and placed in a mold that

carries the configuration of the outer surface of the insert and an elastomeric material is either poured or injected under pressure into the mold to form the insert. One material that has been found successful is a Shore D 75 hardness polyurethane, which results in a very hard high frequency ball striking surface. This plastic insert, not only provides a very hard ball striking surface, but more importantly because it is intimately bonded to the forward wall and the reinforcing bars, it provides an effective "I" beam support with the bars for the forward wall as opposed to a "T" beam support found in today's rearwardly reinforced ball striking wall. It can be easily demonstrated by engineering calculation that I beam supports for transverse loads are substantially stronger than T beam supports.

The increase in the radius of gyration is accomplished by extending the heel and toe portions of the beyond present day parameters for high impact clubheads. These extensions provide greater effective heel and toe weighting. The heel of the clubhead is formed by extending the club face significantly beyond the hosel, that is, on the side of the hosel opposite the ball striking area, and extending the top wall and rear wall to accommodate this extended face. These extensions of the heel and toe are accomplished without any significant increase in overall clubhead weights, by extending the clubhead top wall downwardly almost to the plane of the sole plate, and flattening the rear wall almost to the plane of the sole plate. This design reduces perimeter wall and sole plate wall weight for a given size head and enables the saved weight to be positioned at the extended heel and toe portions of the clubhead.

Another advantage in the downward extension of the top wall and the flattening of the back wall almost to the plane of the sole plate is that at speeds normally encountered in ball driving; i.e., 100 to 150 feet per second, the resulting aerodynamic shape of the head eliminates the negative drag caused by present day clubhead designs as the clubhead passes through the hitting area. This is accomplished by firstly providing the top wall with a known airfoil shape in the vertical plane passing through the clubhead along the target line. Next, the clubhead back wall is flattened almost to the plane of the sole plate, and this results in the arc length of the top wall being somewhat greater than the arc length of the sum of the sole plate and back wall, all taken in that same vertical plane passing through the clubhead along the target line. Following known airfoil technology and the law of continuity of matter, this configuration results in the elimination of prior clubhead drag going through the ball striking area and in fact produces a slight upward force on the clubhead as it passes through the hitting area, and this effects ball overspin which is desirable in a driving club to produce increased total ball distance travel. Ball overspin of course causes the ball to roll further after it initially impacts with the ground.

Other objects and advantages of the present invention will appear more clearly from the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a bottom frontal perspective of a golf clubhead according to the present invention;

FIG. 2 is a bottom rear perspective of the golf clubhead illustrated in FIG. 1;

FIG. 3 is a front view of the golf clubhead illustrated in FIGS. 1 and 2;

FIG. 4 is a rear view of the golf clubhead illustrated in FIG. 1;

FIG. 5 is a right side view of the golf clubhead illustrated in FIG. 1;

FIG. 6 is a left side view of the golf clubhead illustrated in FIG. 1;

FIG. 7 is a top view of the golf clubhead illustrated in FIG. 1;

FIG. 8 is a bottom view of the golf clubhead illustrated in FIG. 1;

FIG. 9 is a front view of the golf clubhead without the plastic insert and with the honeycombing partly fragmented;

FIG. 10 is a longitudinal section taken generally along line 10—10 of FIG. 9;

FIG. 11 is a fragmentary section illustrating the hosel in its relationship to the front supporting wall taken generally along line 11—11 of FIG. 9;

FIG. 12 is a fragmentary section taken generally along line 12—12 of FIG. 9;

FIGS. 13 and 14 are enlarged front and side views of one of the hexagonal cells that support the forward wall of the club face;

FIG. 15 is a perspective view, similar to FIG. 1, with the plastic insert removed, and;

FIG. 16 is a left side view, similar to FIG. 6, with the plastic insert removed.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings and particularly FIGS. 1 to 8, a clubhead 10 is illustrated consisting of an investment cast clubhead body 11 with its forward wall covered by an in situ molded plastic insert 12 thereover.

The clubhead 10 is preferably a thin walled investment cast head constructed of a high strength metal alloy such as 17-4 stainless steel or a high titanium content alloy with aluminum but certain aspects of the present invention can be utilized in clubheads constructed of other materials. The clubhead 10 is a hollow casting that is enclosed by a sole plate 14 constructed of the same material as the clubhead body 11. Sole plate 14 is also investment cast and connected to the clubhead body 11 by heliarc welding around its perimeter. The investment casting techniques for the clubhead body 11, the sole plate 14, and the welding of the sole plate 14 to the body 11 have been well known for at least the past eight years although the unique shape of the clubhead body 11 requires some modification in the shape of the internal core pieces that form the shell of the body, but this presents no difficult molding problems particularly because the rear of the integral forward wall of the body 11 has no reinforcement that requires difficult core pulling.

The forward face of the forward wall 16 of the body 11 is integrally cast with the body 11 and it has a unit-cell pattern 18 that projects forwardly from wall 16 that supports, rigidifies and reinforces the forward wall 16.

The plastic insert 12 may be either cast over forward wall 16 or molded in a pressure molding cycle. The material selected for insert 12 is an extremely high impact, durable and hard material, such as found in the thermosetting elastomeric materials, which of course require a catalyst for polymerization. Insert 12 is translucent so the unit-cell structure 18 can be viewed when the clubhead is assembled.

There are epoxies that will work adequately. However, the Shore D 50 to 75 durometer urethanes have

been found to be superior to the epoxies and one such urethane is Andur[R1]7500-DP manufactured by Anderson Development Company of Adrian, Mich. Other manufacturers of similar urethane products include American Cyanimide Corp., Mobay Chemical Company and Uniroyal Chemical Company.

[1]Andur ® is a registered trademark of Anderson Development Company

The clubhead body 11 is a single casting and in addition to the front or forward supporting wall 16 and the hexagonal unit cell structure 18 includes a top wall 20 from which a short hosel portion 21 projects, and as seen in FIG. 11, hosel portion 21 is part of a tubular hosel 22 that extends completely through the body 11 and connects to an opening 23 in sole plate 14 during assembly. The body 11 is completed by a rear wall 24 that angles upwardly from the sole plate as seen in FIG. 6 in a vertical plane bisecting the clubhead 10 along the target line at an angle of less than 20 degrees.

As seen in FIG. 10, which is a longitudinal section taken in a vertical plane extending along the target line at the geometric center of the club face, the distance A, which is the distance from the plane of the ball striking surface 26 to the rear of the club, is slightly greater than the sum of the distances B and C, which is the distance from the plane of the ball striking surface 26 to the rear of the club along the sole plate 14 and the rear wall 24. Top wall 20 has a standard airfoil section, and one found acceptable is airfoil section NACA 16-510, and the relationship between the distances of A, B and C eliminate downward air foil drag on the clubhead through impact and in fact create a slight upward lift.

As noted above the hexagonal unit-cell structure 18 is integrally cast with the forward wall 16 and includes approximately four horizontally staggered hexagonal cell rows and ten plus vertical rows. An exemplary cell 28 is illustrated in FIGS. 13 and 14 at a scale approximately twice that illustrated in the other FIGS. Each cell is seen to include six wall segments 29 each having a height from the forward surface of wall 16 of 0.150 inches, with a wall thickness of 0.0625, and the minor diameter D_m of the cell is 0.500 inches. The height of the unit-cell structure 16, and thus of course the height of the ball striking surface 26, H_f as shown in FIG. 10, is at least 1.625 inches, and in that respect it conforms to the geometry of the enlarged club face head shown and described in connection with the above-noted Allen, U.S. Pat. No. 5,060,951.

The thickness of wall 16 is 0.070 inches which, as will be appreciated by those with skill in the art, is not by itself thick enough to provide the sole load supporting element in the face. However, when reinforced by the deep depth honeycomb unit-cell structure 18, and the urethane insert 12, the resulting composite wall is far stronger than in any known metallic clubhead conforming to standard weight requirements.

The insert 12 has a depth from its forward surface 26 to the forward surface of the face wall 16 of 0.200 inches so that the insert projects forwardly from the forward surface 31 of the unit-cell structure 18 a distance of 0.050 inches, all resulting in a total composite forward wall thickness of 0.270 inches. Obviously if one were to construct a forward wall with a thickness of 0.270 inches in stainless steel, the resulting clubhead weight would be prohibitively high, but the resulting composite wall designated by reference numeral 34 in FIGS. 10 and 11, has the same weight as an equivalently sized stainless steel wall at 0.125 inches in thickness. The 0.125 inch forward wall is the minimum thickness

forward wall in an investment cast 17-4 stainless steel clubhead that has the necessary structural integrity to withstand the ball impact forces generated at clubhead speeds in the range of 100 to 150 feet per second, while at the same time maintaining overall clubhead weight.

As seen in FIGS. 11 and 12, the hosel tube 22 extends completely through the body 11 and is welded at 35 around sole plate opening 23. Note that a major portion 22*a* of the hosel 22(see FIG. 9) projects through the forward wall 16 and because the hosel 22 is fixed to the top wall at its upper end and the sole plate 14 at its lower end, it provides a very effective supporting strut for forward wall 16 and in fact rigidifies and strengthens forward wall 16 with the honeycomb unit-cell structure 18.

As seen in FIG. 11, face progression is determined by locating the forward surface of the hosel tube 22 at point 37 at the top of the clubhead flush in a vertical plane with the outer surface 31 of the unit-cell structure 18. The ball striking surface 26 however, is 0.050 inches outwardly therefrom at point 37 because plastic insert 12 covers the outer surface 31 of the unit-cell structure by 0.050 inches. Note in the drawings the ball striking face 26, the forward surface 31 of the unit-cell structure 18, and the integral supporting wall 16 all have a loft angle of 10 degrees. This geometry establishes the face progression which is defined in the art as the distance between axis 39 of the hosel shaft to the leading edge 40 of club face 26 in the plane of FIG. 11.

An important aspect of the present invention is that toe portion 44 and clubhead heel portion 45 are in combination further from the geometric center 46 of the clubhead than in standard metal woods, even the "jumbo" style metal woods popular today. Toe portion 44 is 2.062 inches from center 46 and heel portion 45 is 2.062 inches from the same point. This is effected by elongating toe portion 44 and wrapping the top wall 20 and the rear wall 24 around the heel of the hosel tube 22 forming a face wall extension 26*a* as seen in FIG. 9, that is a substantial distance to the right of the hosel tube as seen in the frontal plane of FIG. 9. By locating the toe and heel portions 44 and 45 further from the geometric axis 46 of the clubhead, the radii of gyration of the clubhead about the ball impact point of the heel and toe are increased so the moments about the ball created by these heel and toe portions are proportionately increased. The heel portion 45 extends 0.562 inches from the axis 39 of the hosel in a direction perpendicular to that axis. The extended heel and toe portions 44 and 45 are effected without any significant increase in overall weight by flattening the rear wall 24 toward the plane of the sole plate 14 as seen in FIG. 6, and by the light weight composite forward face 34. An additional advantage in extending the heel 45 beyond the hosel tube 22 is that it reduces the golfer's tendency to slice, which is caused by the clubhead cutting across the target line from right to left at impact.

This anti-slicing feature is enhanced in part because the changed geometry of the toe 44 and the heel 45 actually shifts the geometric center of the club face from point 47 to point 46 closer to the axis 39 of the club shaft.

After the body 11 is investment cast and the sole plate 14 welded thereto, and the head is in its configuration illustrated in FIG. 15, the forward face of face wall 16 and the honeycomb unit-cell structure 18 is sandblasted and vulcanized with a suitable bonding agent. The club-

head is then placed and clamped into a mold having the geometry of the desired plastic insert 12 and the thermosetting material poured or injected into the mold, and then the mold and head are placed into an oven at approximately 310 degrees for 20 minutes depending upon the manufacturer's recommended polymerization parameters for the particular thermosetting elastomer utilized. And, after removing the composite clubhead from the mold, any flash can be removed in the final finishing operations.

I claim:

1. A high impact golf clubhead, comprising: a metallic body having a substantially flat ball striking wall on one side thereof angularly related to a vertical plane to provide clubhead loft, said ball striking wall having a plurality of generally parallel grooves therein and a face height, said ball striking wall having a substantially uniform thickness, said ball striking wall having a heel portion and a toe portion, said body having an integral hosel for receiving one end of a club shaft, means for perimeter weighting the body including an integral metallic perimeter wall surrounding at least a major portion of the ball striking wall and extending rearwardly therefrom forming a cavity in the rear of the clubhead with a bottom defined by the back of the ball striking wall, and means for increasing the perimeter weighting of the clubhead including an extension of the heel portion of the ball striking wall a substantial distance on the side of the hosel opposite the wall toe portion and perpendicular to the target line defining an extended heel portion and an extension of the perimeter wall around the perimeter of the extended heel portion of the ball striking wall, said hosel having an axis, said extension of the ball striking wall and said extension of the perimeter wall not being greater than 0.562 inches from the hosel axis in a direction perpendicular to the hosel axis.

2. A high impact golf clubhead, comprising: a metallic body having a substantially flat ball striking wall on one side thereof angularly related to a vertical plane to provide clubhead loft, said ball striking wall having a plurality of generally parallel grooves therein, said ball

striking wall having a substantially uniform thickness, said ball striking wall having a heel portion and a toe portion, said body having an integral hosel for receiving one end of a club shaft, means for perimeter weighting the body including an integral metallic perimeter wall surrounding at least a major portion of the ball striking wall and extending rearwardly therefrom forming a cavity in the rear of the clubhead with a bottom defined by the back of the ball striking wall, and means for increasing the perimeter weighting of the clubhead including an extension of the heel portion of the ball striking wall a substantial distance on the side of the hosel opposite the toe portion and perpendicular to the target line defining an extended heel portion and an extension of the perimeter wall around the perimeter of the extended heel portion of the ball striking wall, said hosel having an axis, said extension of the ball striking wall and said extension of the perimeter wall being about .500 inches from the hosel axis in a direction perpendicular to the hosel axis, said perimeter wall including a top wall portion, a bottom wall portion and a rear wall portion, said rear wall portion and the top wall portion converging at an acute angle to define a generally pointed heel tip.

3. A high impact golf clubhead, comprising: a base including a high impact forward wall and a perimeter wall surrounding the forward wall with a center and defining a hollow area generally centrally behind the forward wall, said forward wall having a ball impacting face wall with a plurality of generally parallel grooves therein, said forward wall having a substantially uniform thickness inside the perimeter wall to reduce clubhead weight, said base

having a shaft receiving hosel therein having an axis that defines with a leading edge of the forward wall a face progression, and means to reduce a tendency to slice the golf ball including a substantial extension of the perimeter wall and the forward wall outwardly from the hosel in a direction away from the impact center on the forward wall and perpendicular to the target line, said extension being about 0.500 inches.

4. A high impact golf clubhead, comprising: a sloping front face having grooves therein, said front face having a toe portion, a heel portion, and at its base a lower leading edge, said face being generally perpendicular to a target line that passes through the geometric center of the club face, and an integral hosel segment including a bore for receiving a shaft; wherein the hosel segment is inset toward the target line from the heel portion, said face having a portion extending from the hosel in a direction opposite the geometric center generally horizontally, a perimeter wall extending rearwardly from said face portion, and the axis of said hosel bore is spaced from said heel portion a distance of at least 0.500 inches but not more than 0.562 inches.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE: Continuation of Continuation of Reissue Application, U.S. Serial No. 08/880,748, Filed: 6-23-97, a Continuation of Reissue Application, U.S. Serial No. 08/369,910, Filed: 1-9-95 of Dillis V. Allen
INVENTOR: Dillis V. Allen
PATENT NO: 5,301,941
ISSUED: April 12, 1994
FOR: **IMPROVED GOLF CLUB HEAD WITH INCREASED RADIUS OF GYRATION AND FACE REINFORCEMENT**

REISSUE CONTINUATION
SERIAL NO:
FILED:
EXAMINER:
ART UNIT:

U.S. Commissioner of Patents
and Trademarks
Washington, D.C. 20231

[57] ABSTRACT

An improved high impact metal clubhead with a unique reinforced composite face wall, increased radius of gyration, and a positive lift air foil surface contour. The composite face wall includes an impact supporting wall rigidified by a pattern of integrally cast reinforcing bars that extend forwardly, rather than rearwardly, from the supporting wall. The reinforced supporting wall is covered by a very hard plastic ball striking insert that is cast in situ over the supporting wall. The increase in radius of gyration is accomplished by extending the heel and toe portions of the clubhead along the face wall further from the geometric center of the head, beyond present day parameters for high impact clubheads. And the positive lift is effected by contouring the top wall of the clubhead downwardly and rearwardly from the base wall more severely almost to the plane of the sole plate, and flattening the rear wall so it is almost co-planar with the sole plate. This configuration results in the top wall being equal to or greater in length than the combined length of the sole plate and rear wall in a vertical plane extending through the clubhead along the target line. The laws of continuity of matter and the air foil shape of the top wall eliminate the negative lift or drag in today's "woods" and offer the possibility of some positive lift to increase ball overspin.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE:	Continuation of Continuation of Reissue Application, U.S. Serial No. 08/880,748, Filed: 6-23-97, a Continuation of Reissue Application, U.S. Serial No. 08/369,910, Filed: 1-9-95, of Dillis V. Allen
INVENTOR:	Dillis V. Allen
PATENT NO:	5,301,941
ISSUED:	April 12, 1994
FOR:	**IMPROVED GOLF CLUB HEAD WITH INCREASED RADIUS OF GYRATION AND FACE REINFORCEMENT**

REISSUE CONTINUATION
SERIAL NO: _____
FILED: _____

U.S. Commissioner of Patents
and Trademarks
Washington, D.C. 20231

REISSUE CONTINUATION APPLICATION OATH

I, Dillis V. Allen, being duly sworn, depose and say that I am a citizen of the United States of America, and a resident of Elgin, Illinois; that I verily believe myself to be the original, first and sole inventor of the invention described and claimed in Letters Patent No. 5,301,941, and in the foregoing specification and in original Reissue Application Serial No. 08/369,910, Filed 1-9-95, and in a Continuation of Reissue Application, U.S. Serial No. 08/880,748, Filed 6-23-97, of which this application is a Continuation, and for which invention I solicit a Reissue Patent; that I do not know and do not believe that said invention was ever known or used in the United States of America before my invention thereof, that it is claimed that such patent is inoperative or invalid by reason of the patentee claiming more or less than he had the right to claim in the patent, and the following is a distinct specification of the excess or insufficiency in the claims, particularly specifying the errors relied upon, and how they arose or occurred. These errors arose without any deceptive intention on the part of the applicant, and applicant acknowledges the duty to disclose to the Office all information known to applicant to be material to patentability as defined in 37 CFR 1.56.

My U.S. Patent No. 5,301,941 issued on April 12, 1994. Subsequent thereto and on August 10, 1994, in making a routine search through the golf club art, and particularly in Class 273, I found for the first time the Cleveland, U.S. Patent No. 5,312,105, a copy of which appears at pages 1-10 in the accompanying Appendix. This patent discloses the concept of extending the heel 7 beyond the hosel 6 in a direction opposite the ball striking area 9. Upon reviewing the claims in this patent, I found that Claims 1 to 9 claim this feature. This is the feature defined in Claims 12 to 18 of my U.S. Patent No. 5,301,941.

The following is a comparison of Claim 1 in the Cleveland, U.S. Patent No. 5,312,105, with Claim 15 in my U.S. Patent No. 5,301,941.

Cleveland Claim 1: An iron or wood type golf club head comprising: a sloping front face having a grooved striking zone for impacting a golf ball, a toe, and a heel having a tip end, said face comprising in addition to said striking zone a wide zone adjacent said toe and a narrow zone adjacent said heel, and at its base a lower, leading edge; and an integral hosel segment including a bore for receiving a shaft; wherein said hosel extends from said narrow zone between said heel portion and said striking zone, and the axis of said hosel bore is spaced from the tip end of said heel by a distance of at least 8 mm.

Allen Claim 15: A high impact golf clubhead, comprising: a metallic body having a substantially flat ball striking wall on one side thereof angularly related to a vertical plane to provide clubhead loft, said ball striking wall having a plurality of generally parallel grooves therein and a face height of at least 1.40 inches, said body wall having a substantially uniform thickness, said body wall having a heel portion and a toe portion, said body having an integral hosel for receiving one end of a club shaft, means for perimeter weighting the body including an integral metallic perimeter wall surrounding at least a

major portion of the body wall and extending rearwardly therefrom forming a cavity in the rear of the clubhead with a bottom defined by the back of the ball striking wall, and means for increasing the perimeter weighting of the clubhead including an extension of the heel portion of the body wall a substantial distance on the side of the hosel opposite the wall toe portion and perpendicular to the target line defining an extended heel portion and an extension of the perimeter wall around the perimeter of the extended heel portion of the ball striking wall, said hosel having an axis, said extension of the body wall and said extension of the perimeter wall not being greater than 0.625 inches from the hosel axis in a direction perpendicular to the hosel axis.

The Allen Claim 15 is more specific than Cleveland Claim 1 in a plurality of respects. Firstly, my Claim 15 requires a face height of "at least 1.40 inches", and this limitation is not found in the Cleveland Claim 1. And the extension of the heel is defined in the Cleveland Claim 1 as "the axis of the hosel bore is spaced from the tip end of the heel by a distance of at least 8 mm.", while in my patent the extension is defined as "said extension of the body wall and the extension of the perimeter wall not being greater than 0.625 inches from the hosel axis in a direction perpendicular to the hosel axis." These limitations may each be argued to be both broader or narrower than the other depending upon interpretation.

In the accompanying Request by Applicant for Interference with the patent under 37 CFR 1.697, applicant proposes Claim 24 as the Count of the interference. Claim 24 corresponds substantially to Claim 1 in the Cleveland patent. The following is a reading of Claim 24 upon applicant's disclosure, and it is submitted that such Claim is fully supported thereby.

ALLEN CLAIMS CORRESPONDING TO COUNT	DISCLOSURE OF ALLEN REISSUE APPLICATION
Claim 24	
An iron or wood type golf club head comprising:	
A. A sloping front face having a grooved striking zone for impacting a golf ball, a toe, and a heel having a tip end,	A. The club head 10 is a "wood" type as seen in Figs. 1 to 10, 15 and 16, and the ball striking surface of the insert 12 is sloped as seen in Figs. 5, 6, 10 and 11. The insert 12 is grooved as seen in Figs. 1 to 3.
1. said face having a toe portion adjacent the toe and a generally narrower heel portion adjacent the heel, and at its base a lower, leading edge;	As seen in Figs. 3 and 9, the ball striking face is deeper(vertically) at the toe 44 than at the heel 24.
B. An integral hosel segment including a bore for receiving a shaft;	B. Hosel 12 has a bore therethrough as seen in Fig. 11.
C. wherein	
1. said hosel extends between said heel portion and said striking zone,	1. The hosel 21 extends upwardly from the area of heel 24.
2. and the axis of said hosel bore is spaced from the tip end of said heel by a distance of about .500 inches.	2. The axis 39 of the hosel 21 is spaced from the end of the heel 24 a distance of 0.562 inches. See Column 8, lines 48 to 50. 0.562 inches is more than "8 mm." which as a decimal equivalent of 0.3150 inches.

Thus, the first purpose of the present Reissue is to provoke an interference with the Cleveland, U.S. Patent No. 5,312,105. Furthermore, the other Claims in the Cleveland patent; namely, Claims 2, 3, 4, 6, 7 and 8, are also supported by the present disclosure and the subject matter of one of these Claims has been added to the Reissue Application as Claim 20.

Next, Claim 21 has been added to this application because of an unnecessary limitation in Claim 15 in my U.S. Patent No. 5,301,941. Namely, the limitation that the face height be at least 1.40 inches is an unnecessary limitation to the claim and formed no basis for its allowance. The 1.40 inch limitation was originally included in Claim 15 in an effort to define over low impact golf clubs and particularly putters. Putters usually have a face height less than 1.40 inches. However, the limitation is unnecessary because the preamble already defines the clubhead as "a high impact golf clubhead". Claim 21 defines over the prior art in the limitation "means for increasing the perimeter weighting of the clubhead including an extension of the heel portion of the body wall a substantial distance on the side of the hosel opposite the wall toe portion and perpendicular to the target line defining an extended heel portion and an extension of the perimeter wall around the perimeter of the extended heel portion of the ball striking wall, said hosel having an axis, said extension of the body wall and said extension of the perimeter wall not being greater than 0.625 inches from the hosel axis in a direction perpendicular to the hosel axis." Thus, the next reason for this reissue is to present Claim 21 as a slightly broadened version of my patent Claim 15.

Claim 20 differs in scope from all of the original claims for the same reasons patent Claim 15 differs from Claim 1 in the Cleveland patent noted above. Claim 20 depends from Claim 19, and Claim 19 corresponds to Claim 1 in the Cleveland patent. Since Claim 20 corresponds to Claim 4 in the Cleveland patent, which depends from Claim 1 in the Cleveland patent, the differences between Claim 15 in the original patent and Claim 1 in Cleveland are the same as the differences between Claim 20 and the Claims in the original patent. More specifically, Claim 20 does not require a face height of 1.40 inches, does not recite "means for increasing the perimeter weighting of the clubhead" and uses completely different language to express the extension of the heel from the hosel.

Claims 22 and 23 correspond to Claims 19 and 20 except they substitute the word "portion" for the word "zone" in an attempt to overcome the Examiner's argument in parent Reissue application Serial No. 08/369,910, filed 1-9-95, that the patent's original specification did not support the word "zone". Webster defines the word "portion" as "a part which, though not actually separate from the whole, is considered by itself". The terminology "toe portion" and "heel portion" is found in Patent Claim 15.

Claim 25 corresponds to Patent Claim 15 except for: (a) the deletion of the 1.40 inch limitation discussed above; (b) the change of the phrase "not being greater than 0.625 inches" to "about .500 inches" to reflect more closely the value in line 47 of Column 8 of the Patent, and with the addition of the limitation of "said perimeter wall including a top wall portion, a bottom wall portion and a rear wall portion, and the top wall portion converging at an acute angle to define a generally pointed heel tip" in order to more specifically define the shape of the heel projection that minimizes weight addition as described in part in Column 5, lines 24 to 32 as follows:

> "These extensions of the heel and toe are accomplished without any significant increase in overall clubhead weights, by extending the clubhead top wall downwardly almost to the plane of the sole plate, and flattening the rear wall almost to the plane of the sole plate. This design reduces perimeter wall and sole plate wall weight for a given size head and enables the saved weight to be positioned at the extended heel and toe portions of the clubhead."

Next, there is certain prior art cited during the prosecution of the Cleveland, U.S. Patent No. 5,312,105, that was not considered by the Examiner in the prosecution of this patent. While none of this prior art is believed anticipatory of either any of the Claims that issued in my patent nor any of Claims 1, 2, 3, 4, 6, 7 or 8 in the Cleveland patent, it should nevertheless be considered during the following proceedings.

PRIOR ART CITED IN U.S. PATENT NO. 5,312,105
NOT CITED IN THE ALLEN, U.S. PATENT NO. 5,301,941

Johnson, U.S. Patent No. 3,762,717
Judice, U.S. Patent No. 3,967,826
Solheim, U.S. Patent No. 4,621,813
Tunstall, U.S. Patent No. 4,695,054
Fijimura, et al., U.S. Patent No. 4,848,747
Creighton, et al., U.S. Patent No. 4,955,610
Antonious, U.S. Patent No. 5,046,733
Eger, U.S. Patent No. 5,160,136
Solheim, U.S. Patent No. 5,193,805

Foreign Patents:

1,544,211 - United Kingdom
92019329 - World Int. Prop. O.
Hannon, et al.

These patents appear at pages 11 to 120 in the accompanying Appendix to this Reissue Oath.

Additionally, two design patents, namely the Flood, U.S. Design Patent No. 285,473, and the Flood, U.S. Design Patent No. 298,269, were inadvertently not called to the Examiner's attention in the prosecution of this application underlying my patent for the simple reason that copies of these patents were in a different file and were not added to the patent application file as they should have been. Copies of these design patents appear at pages 98 to 102 in the accompanying Appendix. These two patents were called to my attention by the very law firm of Parkhurst, Wendel & Rossi, 1421 Prince Street, Suite 210, Alexandria, Virginia, that prosecuted the underlying Cleveland application in a letter dated December 1, 1992, which interestingly corresponds to the filing date of the underlying Cleveland application. A copy of this letter appears at page 103 in the accompanying Appendix and is seen to be a reply to my allegation that claims in my application underlying my issued patent might, when issued, cover the Cleveland VAS irons manufactured by Cleveland Classics. These irons are similar to the Fig. 9 and 10 embodiment in the Cleveland, U.S. Patent No. 5,312,105. The Cleveland attorney's letter of December 1, 1992, was an obvious suggest-

ion that the Flood patents may anticipate any claims in my application drawn to the feature of the heel projecting from the hosel in a direction opposite the ball striking face. If that be the case, it is incomprehensible that Cleveland's attorneys did not call the Patent Office's attention to the two Flood patents in its Information Disclosure Statement filed the following month, on January 14, 1993, and a copy of that Information Disclosure Statement is included in the accompanying Appendix at pages 104-105, and it seems somewhat inconsistent that Mr. Cleveland's attorneys would represent to myself at the very date of filing of the Cleveland application, that the Flood patents reflect on the validity of any claims in my application drawn to the heel extension feature, when in fact Mr. Cleveland's attorneys planned to and did prosecute claims to that very feature and never called the Examiner's attention to the two Flood patents.

In any event, these two Flood patents should be considered during the following proceedings.

Further, two additional publications, the Flood, U.S. Des. Patent No. 340,492, and the British Published Application 2,230,459, have been called to the Patentee's attention since the filing of the parent Reissue Application U.S. Serial No. 08/369,910, Filed: 1-9-95. These patents appear at pages 106-120 of the accompanying Appendix, and are not believed to affect the patentability of any of the presently offered Claims, but should be considered by the Patent and Trademark Office.

Claim 1 has been amended to change the word "case" to "cast". Claim 1 as allowed in the underlying application, recited "cast", so this error was a printing error which this amendment is intended to correct.

Finally, Claims 1, 2 and 3 contain a typographical error that apparently was effected by the printer; namely, the term "gold" in the first line of all three of these claims should, of course, be "golf" and the changes to Claims 1, 2 and 3 are designed to correct this error.

To more fully explain the manner in which the errors occurred over and above those set forth in the original Oath, and as required by the Examiner on page 4 of the Office Action, applicant states as follows:

The routine search in the golf art by applicant is of course relevant to some of the errors but not the "occurrence" of the errors. The search was relevant to the discovery of some of the errors because this patentee found for the first time Mr. Cleveland was not only granted claims that conflict with the patentee's, but that some of those claims appeared broader than the patentee's. Hence, the patentee discovered at that same time that the patentee might be entitled to the broader Cleveland claims because the Patent and Trademark Office found them allowable in the underlying Cleveland application. The typographic errors in Claims 1 to 3 were discovered for the first time in December of 1994 and early January of 1995, when the patent claims were reviewed in the preparation of this reissue application.

Inventor's Full Name: Dillis V. Allen

Post Office Address: 31W211 Route 58
Elgin, Illinois 60120

Date: 8/14/99

Dillis V. Allen
Inventor

Dillis V. Allen, President
Vardon Golf Company, Inc.
Assignee

STATE OF ILLINOIS)
) SS.
COUNTY OF COOK)

Subscribed and sworn to before me this 18th day of August, 1999.

Irene F. Allen
Notary Public

Commission expires: 10-18-01

OFFICIAL SEAL
IRENE F ALLEN
NOTARY PUBLIC, STATE OF ILLINOIS
MY COMMISSION EXPIRES: 10/18/01

BALANCED GOLF PUTTER

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates in general to a golf club for putting on a green and more particularly to a putter specifically balanced for more controlled hitting. The putter includes a putterhead, a shaft portion attached to the putterhead including a grip attached to the upper end of the shaft.

Background of the Invention

A golfer requires more accuracy when putting on the green than at any other time during the game because, during putting, the target is a hole approximately four and one half inches in diameter. To achieve this accuracy, a golfer must use a club so constructed as to provide maximum resistance to putter rotation during the stroke and at moment of impact.

To this end, it is a principal object of this invention to provide a golf putter that has a zero rotation point within the striking face at the sweet spot when the striking face makes contact with the golf ball.

Another principal object if to provide a golf putter that does not promote a tendency to open or close at anytime during the golfer's putting stroke.

Also, the feedback that a golfer receives while moving a golf putter and while striking a ball is very important.

It is desirable to have a putter head that transfers a greater amount of feedback vibration up the shaft to the golfer. It is desirable to have a putter head with a better indicator for alignment to the ball.

SUMMARY OF THE INVENTION

Broadly speaking the invention is a golf putter that produces a smoother stroke, does not attempt to turn in the golfer's hands, and provides superior feedback to the golfer.

According to the invention, a putter comprises a putter head, a shaft, and a grip. The putter head comprises an elongated body having a toe end, a heel end, a fore side between the heel end and toe end including a ball striking face, an aft side opposite said fore side, a sole, and a top side. A longitudinal axis runs heel to toe parallel with the ball striking face.

The head includes a bore for attaching the putter shaft to the body such that the line of the shaft axis passes substantially through the center of mass of the head.

In a preferred embodiment, the body includes two chambers entering the body form the sole. One Chamber is located on the heel side of the center of mass and one chamber is located on the toe side of the center of mass. The chambers increase the proportion of heel and toe mass relative to the center mass and decrease the transverse cross sectional area of head material and thereby increase vibration up an attached shaft upon ball impact. The chambers each exit the top side in a transverse slot. The transverse slots are approximately a ball width apart from each other and equal distance on each side of the center of mass of said head.

The entire putter is balanced so as to be more stable in a golfer's hands. A neutral balanced putter has no moment about the shaft axis. A face balanced putter has weight distribution such that, when the shaft is laid across two parallel balance edges, the putter will come to rest with the longitudinal axis level.

The balanced putter of the invention also provides superior feedback to the golfer upon striking the ball, and is superior in visual alignment to the ball.

Other features and many attendant advantages of the invention will become more apparent upon a reading of the following detailed description wherein like reference numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a perspective view of a preferred embodiment of the golf putter of the invention.

Figure 2 is a side elevation view of a preferred embodiment of the putter head and shaft mounting.

Figure 3 is a top view of the putter head of Figure 2.

Figure 4 is a bottom view of the putter head of Figure 2.

Figure 5 is sectional view taken on line 5-5 of Figure 2.

Figure 6 is a view of the putter of Figure 1 showing the head position of the balanced putter when the shaft is laid over a pair of parallel, balance beams.

DETAILED DESCRIPTION OF THE INVENTION

With reference now to the drawings, and more particularly to Figure 1 thereof, there is shown a perspective view of a preferred embodiment of the balanced golf putter, denoted generally as 10, of the present invention.

The putter generally comprises a putting head, denoted generally as 20, and a shaft portion comprising a substantially straight shaft, denoted generally as 60, and a grip, denoted generally as 80. The terms golf club or putter as used herein is defined to mean the total

club or putter including any other attachment, such as a hosel which may be used to attach a shaft to a head and is considered part of the shaft portion.

Shaft 60 is typically a hollow metal cylinder having a lower end 62 to which grip 80 is attached. Shaft 60 typically tapers slightly in diameter from upper end 62 to lower end 66 where it is attached to head 20. The central portion 64 of shaft 60 is substantially straight and has a shaft axis 65, as seen in Figure 6.

With reference now to Figures 2-5 there is shown a preferred embodiment of the putter head 20 of the present invention. Figure 2 is side elevation view of putter head 20 also showing shaft lower end 66. Figure 3 is a top view of the putter head 20 of Figure 2. Figure 4 is a bottom view of the putter head 20 of Figure 2. Figure 5 is sectional view taken on line 5-5 of Figure 2.

Putter head 20 has an elongated, generally rectangular shaped body 22, typically comprised of metal, such as brass or 6061 T6 aluminum. Shaft 60 is attached to body 22 at an angle by means such as slanted bore 23. The end of body 22 under shaft 60 is designated the heel end, denoted generally as 24, the other end is designated the toe end, denoted generally as 25. Typically, the heel end 24 of putter head 20 is closest to the golfer during use. Along one side of body 22 between the heel 24 and toe 25 is a fore side, denoted generally as 40, including a golf ball striking face 42. The other side between heel 24 and toe 25 is designated aft side 44. The bottom side is designated as sole 46; the upper side is designated as top side 48. The putter head sides 40, 44, 46, 48 have generally smooth planar surfaces. A heel/toe axis or longitudinal axis 29 passes from heel to toe parallel with ball striking face 42.

Chambers, denoted generally as 30, are disposed in

body 22 toward the heel 24 and toward the toe 25 from the attachment of shaft 60. In the preferred embodiment, a portion of chambers 30 exit top side surface 48 as slots 36. Slots 36 increase the vibrational resonance of chambers 30 by decreasing the mass supporting the heel and toe masses toward the heel and toe from chambers 30 and further decreasing the stiffness of head 20. Slots 36 also act as ball alignment slots visible to the golfer. Preferably, slots 36 are the width of a golf ball apart from each other.

Shaft 60 attaches at an angle of 10 degrees or greater; preferably of 12-24 degrees. Shaft 60 is attached to body 22 such that the line 65 of the shaft axis passes substantially through the center of mass of head 20.

Head 20 of the preferred embodiment is approximately 4.5 inches in length, 0.625 inches wide at the top and 0.6875 inches wide at the bottom and 0.8975 inches height. Sole 46 is concave upwards longitudinally with a radius of 7.5 inches. The heel and toe ends are radiused to fair sole and top side. Chambers 30 open at the bottom onto sole 46 and are 0.6250 inches wide fore/aft, 0.375 inches wide heel/toe, and 0.7875 inches in height below alignment slots 36 with rounded corners of 0.125 radius. Slots 36 are 1.00 - 1.68 inches apart and are 0.0625 inches wide and 0.625 inches long. Fore and aft sides 42,44 are tapered upward by four degrees. Sole 70 is concave upwards transversely with a radius of 12 inches. Fore and aft sides 42,44 fair with top side 48 with a radius of 0.0625 inches. A typical shaft bore is 0.355 inches. A typical putter head has a weight of 308 grams. The entire shaft 90 typically weighs about 3.5 ounces.

As seen in sectional view in Figure 5, chambers 30

putter having no moment about the shaft axis. In its simplest form, a neutral balance putter has a shaft portion having its center of mass on the shaft axis and the line of the shaft axis passes through the center of mass of the head. For example, this can be achieved with a head that is a rectangular parallelepiped and a symmetrical circular shaft that passes through the center of the head.

In another idealized form, the neutrally balanced putter head has weight distribution symmetry about a fore/aft vertical plane and has weight distribution symmetry about a heel/toe vertical plane, and the shaft has no moment about its axis and passes through the mass center of the head.

With reference now to Figure 6, there is shown one method of balancing a putter according to the invention. The putter 10 of Figure 1 is shown in the balancing position with shaft 60 horizontal and lying over two balance beams 90 such that putter 10 can be freely rotated on the beams 90. Ideally, beams 90 can be considered two frictionless support lines that support the putter and allow putter 10 to be freely rotated about shaft axis 65. In practice, beams 90 may be triangular prisms. For this discussion, the shaft is considered to be cylindrical or supported by the beams 90 at cylindrical locations, otherwise, and in the alternative, for the balancing test the club could be supported, such as by pins, in each end of the shaft axis so that the club can freely rotate about the shaft axis..

When placed on balance beams 90, the neutrally balanced putter has no tendency to rotate if undisturbed and has no preference for stopping position if disturbed. This is because the center of mass of the neutral balance putter is on the shaft axis.

Putter 10 shown is face balanced, i.e. the total weight of putter 10 is distributed such that, when the club is supported so that it can rotate freely about the shaft axis, the longitudinal axis of the head will be level. In the balancing position shown in Figure 6, face balanced putter 10 will come to rest in the position shown in Figure 6 with longitudinal axis 29 being level, i.e. horizontal or normal to the gravity vector. A face balanced putter has its center of mass directly in the direction of one of the two faces from the shaft axis. Preferably, the striking face 42 will be downward facing. In this case, the center of mass of said club is directly in the direction of the striking face from the shaft axis.

Several methods may be used to balance putter 10. The preferred method comprises constructing a putter 20 substantially as dimensionally described above with the axis of a straight shaft 60 passing substantially through the mass center of head 20. Grip 80 is attached to shaft 60. The putter is then supported as shown in Figure 6. At this time, the putter will rotate until the center of gravity of the putter is at its lowest point. If longitudinal axis 29 is not level, weight is removed from the low end of putter head 20 by machining away a bit of the head until the head will lie level, i.e. balanced, in the balancing position. Conversely, weight could be added to the high end of the head 20. Of course, weight could be added or subtracted from the corresponding toe side or heel side of the shaft and/or grip, but making corrections at the heel and/or toe end of putter head 20 requires a smaller weight change because of their increased distance from the shaft axis 65.

Preferably, the faced balance putter has the center of mass of the putter directly between the shaft axis and

the striking face as shown in Figure 6 such that the striking face 42 ends up downward facing. A neutral balanced putter can be made a face balanced putter by adding or removing weight such that the center of mass is moved directly toward or away from the striking face.

Weight can be added in any known form such as liquid, solid or powder, and weight can be removed by any suitable method such as machining, abrading, or creating cavities. Any combination of the above including both adding and deleting weight may be used.

Although a particular embodiment of the invention has been illustrated and described, various changes may be made in the form, construction, and arrangement of the parts herein, without sacrificing any of its advantages. Therefore, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense and it is intended to cover in the appended claims such modifications and changes as come within the true spirit and scope of the invention.

As used in the following claims, the term golf "club" includes an entire club, i.e. a ball striking head and a shaft and anything attached thereto. The term "head" includes anything other than the shaft attached to the head. The term "shaft" includes anything other than the head attached to the shaft, e.g. a grip or hosel.

CLAIMS:

1. A golf club having:

a head;

a substantially straight shaft having a longitudinal axis; said shaft including;

an upper end; and

a lower end; said shaft lower end attached to said head; and

grip means on said shaft upper end for gripping by a golfer;

the center of mass of said shaft and grip means being off said shaft longitudinal axis; the center of mass of said club being substantially on said shaft longitudinal axis.

IMPROVEMENTS IN GOLF CLUBS

This invention relates to golf clubs.

In manufacturing golf clubs, it is important to be able to control the distribution of weight within the club head and for the club head to have a strong and rigid construction. It is further important that the club head has a firm fixed fitting on the end of a shaft.

In a first aspect the present invention provides a club head for a golf club known as a wood which is characterised in that the head is made in two or more parts which are connected together and a socket within the head is provided which is connected to both parts and which has a bore therein for receiving the end of a shaft for connection of the club head to the shaft. The socket may be provided as a seperate element and may be made in one piece. The socket may be connected to one of said parts of the head through being formed, eg cast, integrally therewith. The socket may be connected to one of said parts by welding, fusing or adhesive. The socket may comprise separate interfitting elements which are themselves connected, e.g. cast, to said parts of the head.

The socket is preferably arranged so that it receives the end of the shaft with the shaft penetrating to the sole of the club head. The club head may be without the usual hosel extending up the shaft from the club head. The parts of club head are preferably made as shell sections and form a hollow club head.

In another aspect the invention provides a method of assembly of a golf club using an elongate shaft and a club head, in which a bend is provided in

the shaft so that a lower end portion of the shaft lies at an angle to the longitudinal axis of the shaft and a bore is provided in the club head for receiving said lower end portion of the shaft, which method includes the step of selecting a "bias angle" (as defined herein) for the assembled club in dependence upon the swing characteristics of the intended user and connecting together the club head and shaft such that the assembled club has said desired "bias angle".

The "bias angle" may be chosen to be substantially 45° (the "neutral bias angle"), greater than the "neutral bias angle", e.g, for slicers of the ball or less than the "neutral bias angle", e.g, for hookers of the ball.

In a further aspect, the invention provides that the grooves on the face of a club head are arranged to be of less depth at the toe of the club head than at the heel of the club head to provide compensation for off-centre strikes of a golf ball and resultant differences in trajectory.

By way of example, embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a sectional view through a club head in accordance with the invention,

Figure 2 is a view of the face of the club head of Figure 1,

Figure 3 is a view of the top of the club head of Figure 1,

Figures 4 and 5 show the club head with different shafts attached,

Figure 6 diagrammatically illustrates the "bias angle" of a conventional golf club, and

Figure 7 diagrammatically illustrates the "bias angle" of a golf club in accordance with the present invention.

In Figure 1 there is seen a club head 10 for a golf club known as a "wood". The club head 10 here is made of metal, which is preferably steel. Other materials, eg carbon or graphite could equally well be used. The club head 10 is of a hollow shell structure and comprises interfitting first and second shell parts 11, 12. The interior of the finished club head normally contains a filler, eg foam.

The first part 11 here comprises the main body of the club head, including the ball-striking section 13, the top 14 and bottom 15. A recess 16 is provided in the bottom 15 of the club head and a hole 17 is provided in the top 14 of the club head.

The second shell part 12 here comprises a sole plate 18 which is configured and arranged for receipt in the recess 16, as is seen in Figures 1 and 3. The sole plate 18 is attached, eg by welding, around its periphery in the recess 16 to the bottom 15 of the club head. The club head 10 additionally comprises a socket 19. Here, the socket 19 is provided as an integral part of the sole plate 18, eg by being cast therewith. The socket 19 can alternatively be a separate part and connected to the sole plate 18, eg by welding. The socket 19 extends from the sole plate 18 so as to be engagable in the hole 17 when the sole plate is received in the recess 16, as seen in Figure 1. The socket 19 is attached, e.g. by welding, around its periphery in the hole 17 to the top 14 of the club head. The socket 19 may extend slightly proud of the top 14 of the club head, as seen in Figure 1. This construction of club head, with the two shell parts connected together at the top and bottom of the head and the socket extending therebetween, provides a very effective rigid and strong structure. It also means that the weight of the head is distributed advantageously in a region giving optimum feel and

weight behind a shot.

It will be understood that the configurations of the interfitting parts of the club head may be varied. For example, more than two shell parts may be used and the socket may be formed in more than one piece, possibly as part of the shell parts themselves.

The socket 19 defines a bore 20 for receiving the end of a shaft 21. The shaft 21 is retained in the bore 20 by adhesive, and grooves may be provided on the inside of the bore to enhance the security of the shaft in the bore. The absence of the usual neck or "hosel" on the top of the club head reduces the effect of drag when the club is swung.

Here, the club head is seen with a shaft 21 having a bend 23. The angle a of the axis of the bore 20 of the socket element 19 relative to the sole plate 18 is chosen to complement the angle b of the bend 23 in the shaft 21. In particular, angles a+b = 90°. One purpose of the bend b in the shaft is to set the club head relative to the shaft, and in particular to the golfer's hands, so that the face of the club head is at least no further forward than the longitudinal axis 22 of the shaft. This is illustrated in Figures 4 and 5. In Figures 4 and 5, the amount of "set" in the club is adjusted by varying the length of the bent end portion of the shaft. In addition or alternatively, the amount of "set" in the club could be adjusted by varying the angle b of the bend in the shaft. In Figure 4, the face of the club head is as far forward as the longitudinal axis 22 of the shaft, whereas in Figure 5, the face is set back by the distance of half a golf ball's diameter d. In Figures 4 and 5 the angles a and b can be seen. Angle c in Figure 2 represents the angle of lie of the club, and the socket is arranged to suit this angle also.

The technology of bending shafts is known and is

therefore not explained in detail here. Suffice it to say that care is taken when bending the shaft to ensure the cross-section of the shaft remains circular.

Another purpose of the bend 23 in shaft 21 is to enable the golf club to be set up with a desired "bias angle" to suit the particular swing characteristics of individual golfers. The "bias angle" is defined herein as the angle which the plane of the face of the club head subtends to the vertical when the club is placed with its shaft on a horizontal surface and its head is allowed to overhang the surface and rest freely. Figures 6 and 7 are illustrations showing the "bias angle" x of a conventional golf club and a golf club according to the present invention, respectively. The golf clubs seen in Figures 6 and 7 are "woods", but the "bias angle" principle may also be applied to golf clubs known as "irons" and "putters".

The "bias angle" x may be selected to be substantially 45° ("neutral bias angle"). This can be achieved by arranging for the axis of the lower (bent) portion of the shaft to intersect the centre of mass of the club head. Variable weighting for such a club has to be effected on the midline of the sole (imaginery line which bisects the club head into two equal masses) if the "bias angle" is not to be disturbed. A golf club with a "neutral bias angle" will be dynamically balanced since no internal forces will be present during the swing tending either to open or close the club face. A golf club with a "neutral bias angle" is seen in Figure 7, and this mimics the correct position of the shaft and club head at the top of the backswing.

If the "bias angle" is altered from the "neutral bias angle", the effect of this will be to relocate the centre of mass of the club head relative to the

shaft. This will mean that instead of there being a dynamic balance of the club in motion, internal forces will be present in the club which create a tendency for the face of the club to be turned towards either a more open or more closed position. This effect can be used as a corrective measure to counter a natural tendency which an individual golfer may have of opening or closing the club face during the swing. For example, for golfers who tend to fade or slice the ball and for whom the club face tends to be too open at the top of the backswing, a "bias angle" greater than the "neutral bias angle" is selected, say 60°, so that the internal forces present in the swing will be urging the club face towards a less open position. For golfers who tend to draw or hook the ball and for whom the club face tends to be too closed at the top of the backswing, a "bias angle" less than the "neutral bias angle" is selected, say 30°, so that the internal forces present in the swing will be urging the club face towards a less closed position.

The "bias angle" of a club is selected by suitably adjusting the angle and length of the (bent) lower end portion of the shaft and matching this with a suitable configuration of the bore in the club head. Where the club head is one which is made in accordance with the foregoing description, this means suitably configuring the socket 19. Conventional golf clubs are not set up with a selected "bias angle". It happens that the "bias angle" of conventional woods, as seen in Figure 6, usually turns out to be about 20° or less.

Reference 24 designates grooves on the face of the club head. The grooves 24 impart backspin to the golf ball when it is struck, encouraging greater height to the ball's trajectory. A ball struck from towards the toe of the face of a club head has a

tendency to rise higher than one struck from towards the heel of the face. Accordingly, the depth of the grooves 24 is arranged to be less at the toe than at the heel to provide compensation for strikes of golf balls which are off-centre.

CLAIMS

1. A club head for a wood which is characterised in that the head is made in two or more parts which are connected together and a socket within the head is provided which is connected to both parts and which has a bore therein for receiving the end of a shaft for connection to the club head of the shaft.

2. A club head as claimed in Claim 1 wherein the socket is provided as a separate element.

3. A club head as claimed in Claim 2 wherein the socket is made in one piece.

4. A club head as claimed in any preceding claim wherein the socket has a connection with one of said parts through being formed, eg cast, integrally therewith.

5. A club head as claimed in any preceding claim wherein the socket has a connection with one of said parts by welding, fusing or adhesive.

6. A club head as claimed in any preceding claim wherein the socket is arranged so that it receives the end of the shaft with the socket and shaft penetrating to the sole of the club head.

7. A club head as claimed in any preceding claim wherein the club head is without a hosel extending up the shaft from the club head.

8. A club head as claimed in any preceding

claim wherein the parts of club head are made as shell sections and form a hollow club head.

9. A club head substantially as herein described with reference to the accompanying drawings.

10. A method of assembly of a golf club using an elongate shaft and a club head, in which a bend is provided in the shaft so that a lower end portion of the shaft lies at an angle to the longitudinal axis of the shaft and a bore is provided in the club head for receiving said lower end portion of the shaft, which method includes the step of selecting a "bias angle" (as defined herein) for the assembled club in dependence upon the swing characteristics of the intended user and connecting together the club head and shaft such that the assembled club has said desired "bias angle".

11. A method as claimed in claim 10 or claim 11 wherein the club head comprises a club head as claimed in any one of claims 1 to 9.

12. A club head for a golf club wherein the grooves on the face of the club head are arranged to be of less depth at the toe of the club head than at the heel of the club head.

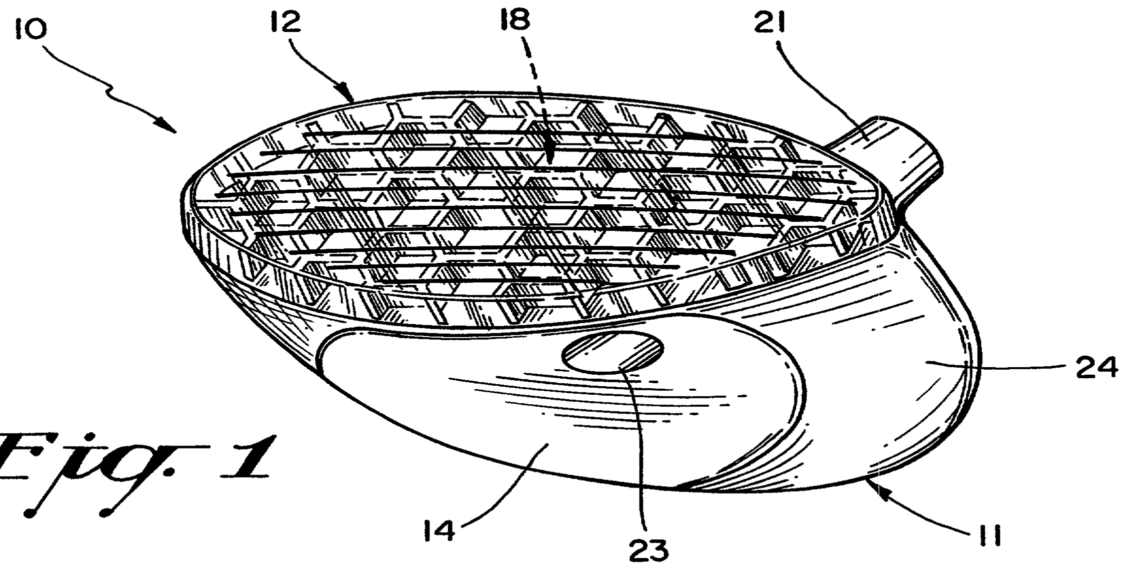

Fig. 1

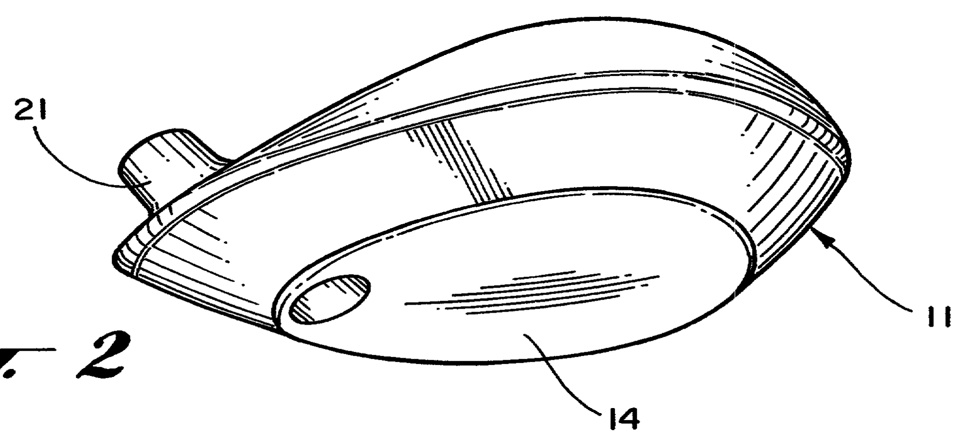

Fig. 2

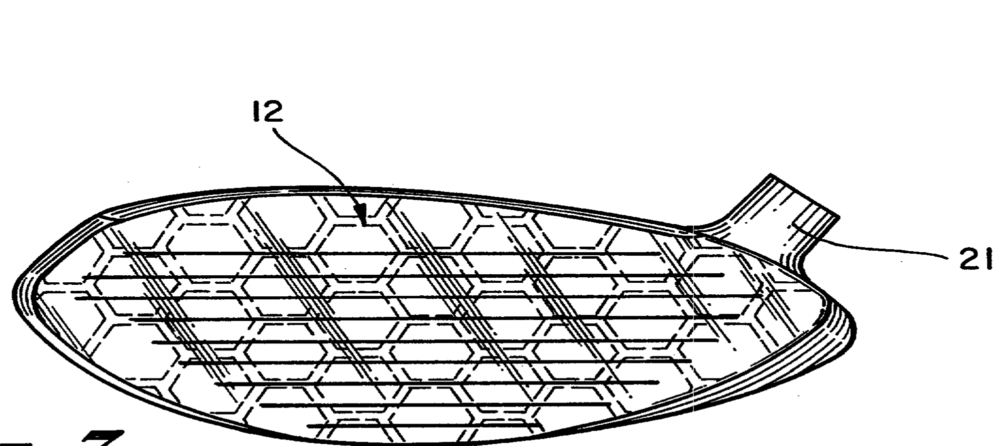

Fig. 3

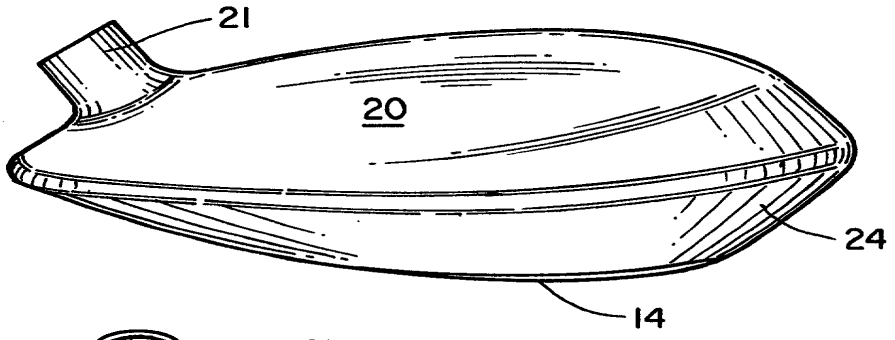

Fig. 4

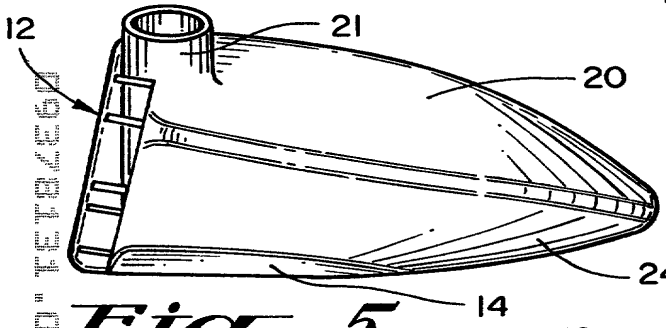

Fig. 5

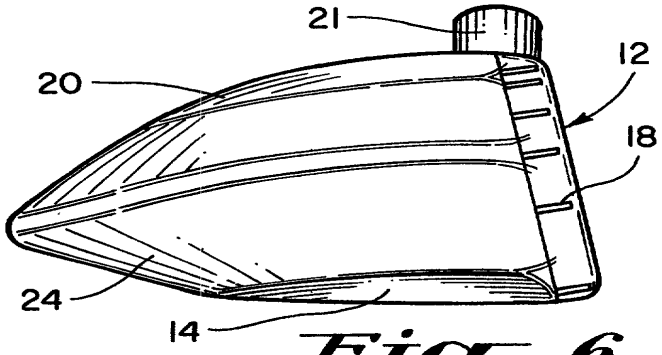

Fig. 6

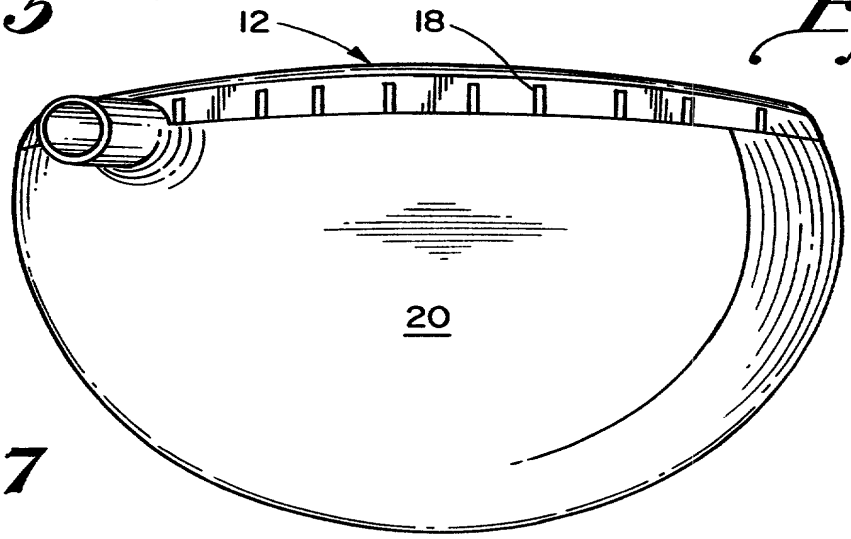

Fig. 7

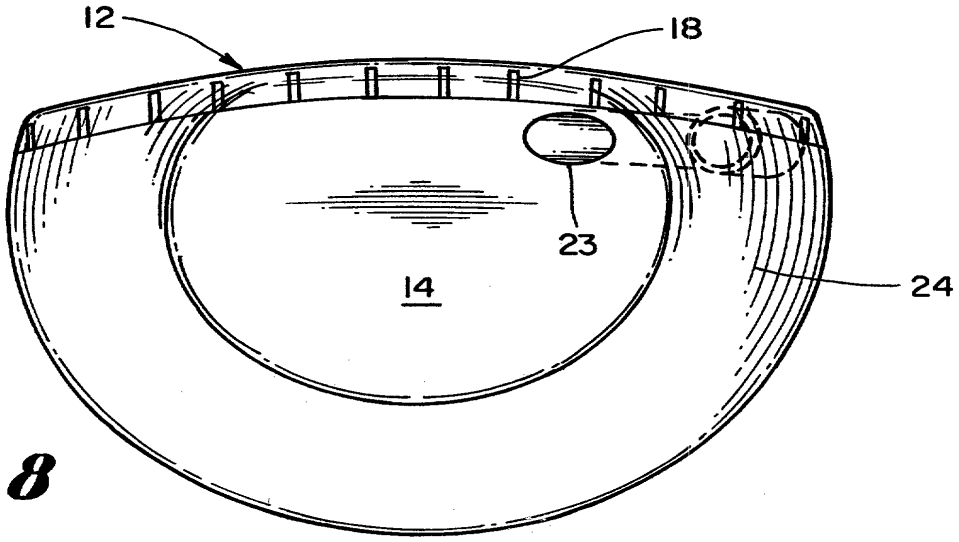

Fig. 8

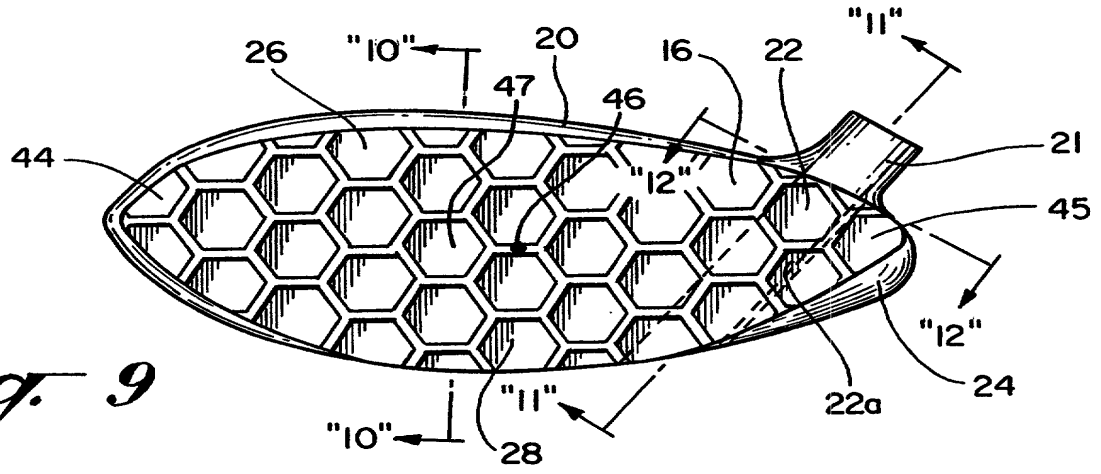

Fig. 9

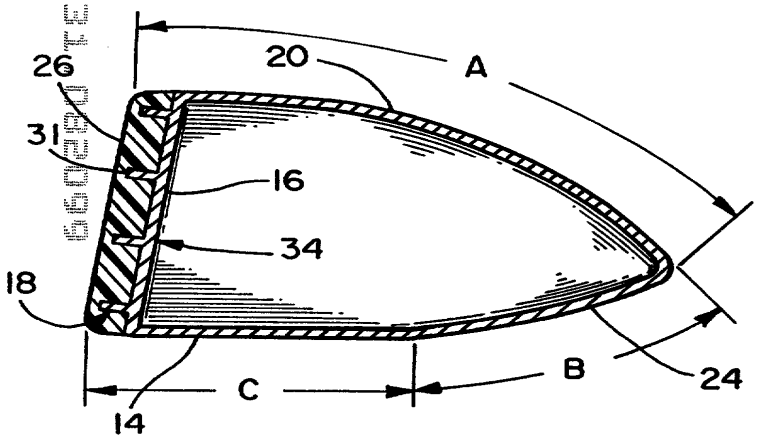

Fig. 10

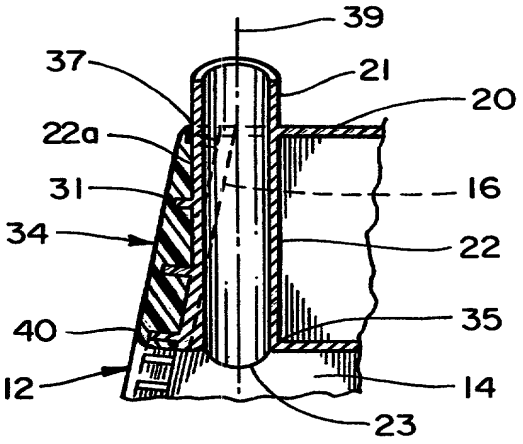

Fig. 11

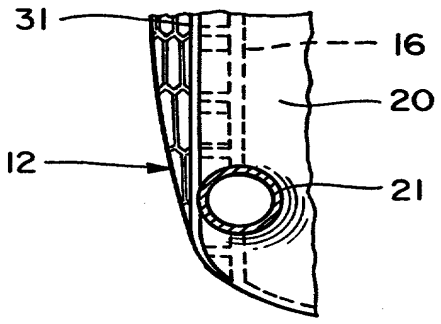

Fig. 12

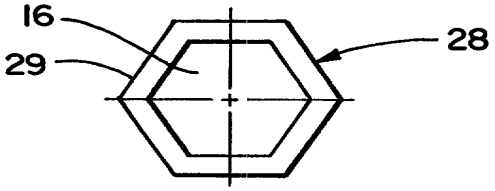

Fig. 13

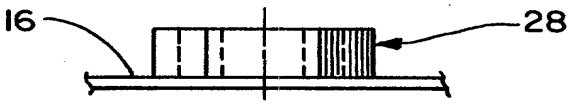

Fig. 14

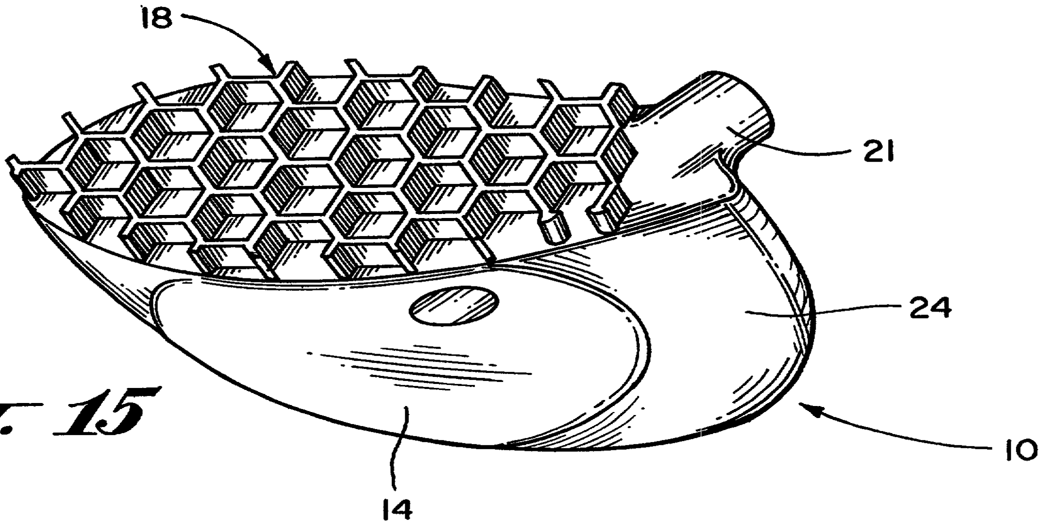

Fig. 15

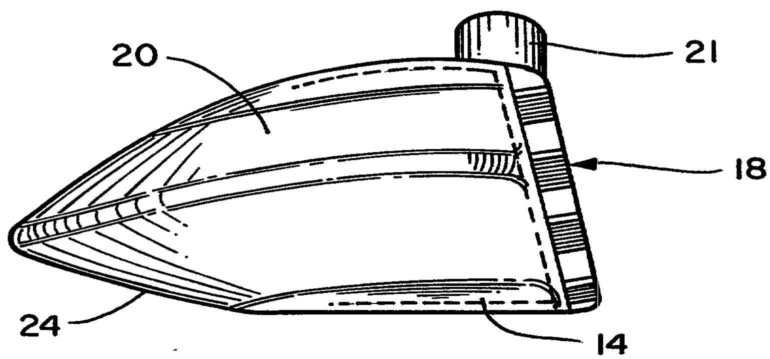

Fig. 16

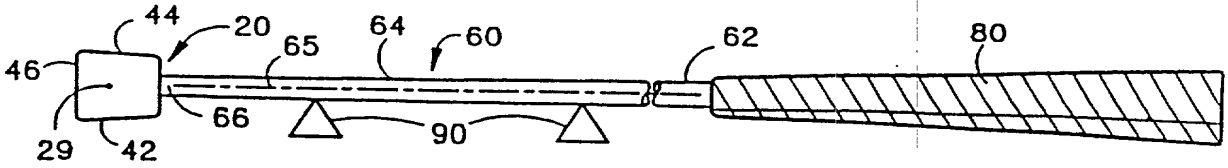

FIG. 6

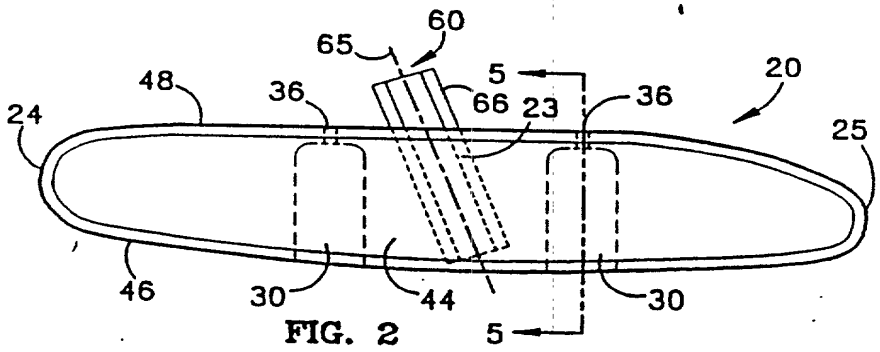

FIG. 2

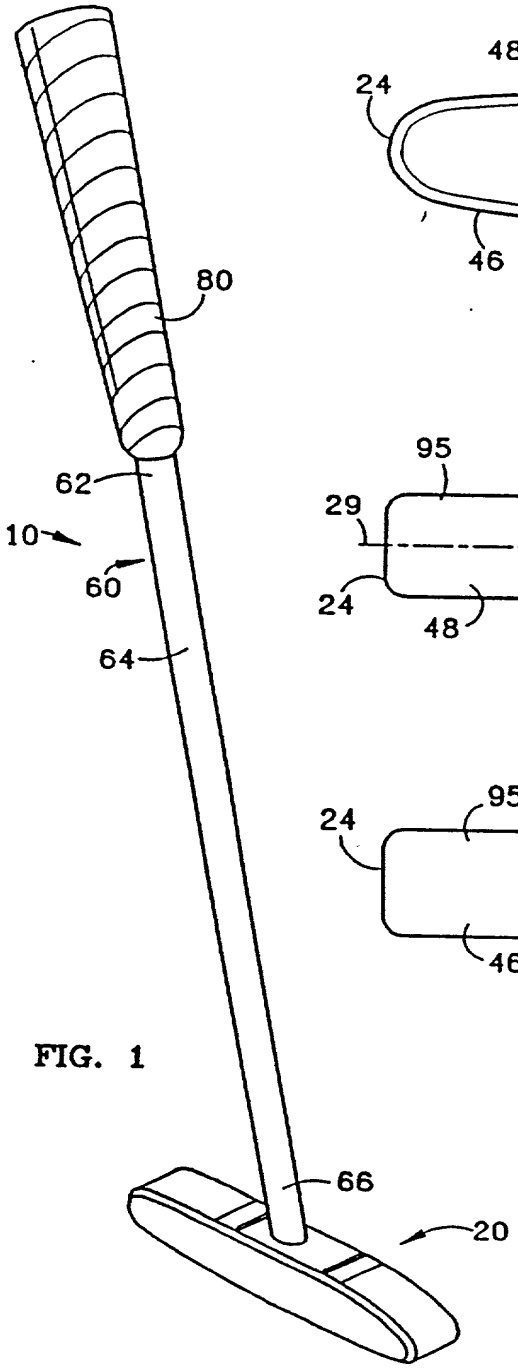

FIG. 1

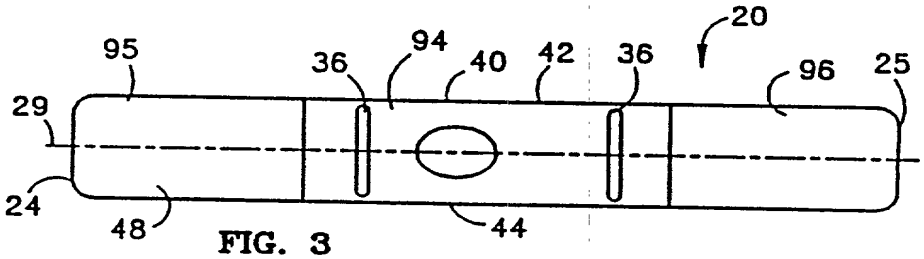

FIG. 3

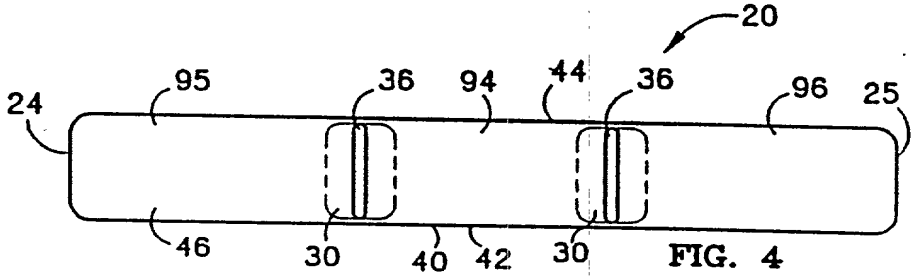

FIG. 4

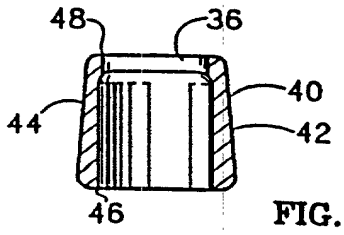

FIG. 5